TRANSLATION (HM-665PCT):

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DEVICE FOR RECIRCULATING OIL IN ROLL BEARINGS

The invention concerns a device for recirculating oil from the area of the end face of the barrel and the peripheral surface of the roll neck of rolling mill rolls, which roll neck is supported in the bearing of a bearing chock, wherein a sealing race, which is arranged between the bearing elements and the end face of the barrel, is mounted on the roll neck.

It is well known that in rolling mill rolls, which are supported in and carried by bearing chocks, these bearings can be furnished with sealing races mounted on the roll necks against the roll necks of the roll and the roll barrel and can be sealed with additional flexible elastic gaskets, which partly form labyrinths and are connected with the roll neck and the bearing housing. The sealing devices generally satisfy the sealing requirements of a rolling operation.

In the rolling of rolled strip, for which quality requirements are especially stringent, e.g., in the case of rolling in dry temper rolling stands, the barrels of the rolls must be kept completely free of dirt and oil, since even a few

individual drops of oil that get on the peripheral surface of the rolls in the rolling area from the bearing through the end face of the roll barrels have an adverse effect on the surface quality of the roll barrel and often make it necessary to change the rolls completely.

Attempts have already been made to admit compressed air into the sealing labyrinths to produce a flow of oil under the sealing races towards the bearing and thus to counteract this escape of drops of oil. This measure also proved unsuitable for reliably preventing the escape of individual drops of oil with the frequent result that the quality defects caused by the escape of oil were not detected until the inspection line following the rolling of the strip, usually not until after several coils of strip had been rolled, which by then all had the same defects.

Proceeding from a proposal made in FR 1,470,057 to improve the previously known oil recirculation systems with the goal of eliminating the risk of the escape of even small amounts of oil by using a conical ring body with a cylindrical inner surface that is seated on the outer surface of the sealing race and is sealed from said race for the purpose of recirculating oil, wherein the conical ring body has a conical outer surface, such

that the inclination of the conical outer surface towards the end face of the barrel runs towards the roll axis, and by assigning to this first conical ring body an additional, second conical ring body that is rigidly mounted in the bearing housing and has a conical inner surface, which is arranged some distance opposite the conical surface of the first conical ring body, such that the two conical surfaces form a hydraulic pump gap that conveys oil away from the end face of the roll barrel, the invention improves the action of this pump gap and improves the oil conveying channels by virtue of the fact that the end of the pump gap that faces the roll barrel opens in an annular admission chamber, which is formed by lateral surfaces of the first conical ring body, which run in the radial direction relative to the axis and inclined thereto, by the radial lateral surface of a flange-like annular shoulder of the second conical ring body, which (radial lateral surface) lies some distance opposite the lateral surfaces of the first conical ring body, and by an outer surface section of the sealing race. In this regard, the outlet end of the pump gap that faces away from the roll barrel can open in an annular oil collection chamber, which is formed by a radially running lateral surface of the second conical ring body, by a lateral surface of a flange-like annular

shoulder that is rigidly mounted in the bearing housing and lies some distance opposite the aforesaid lateral surface of the second conical ring body, and by a sidewall section of the first conical ring body, such that radial conveying channels, which are located in the bearing housing, and an outlet channel, which is located downstream of the radial conveying channels, are assigned to the oil collection chamber.

The objective of the invention is to improve the previously known oil recirculation systems by eliminating the risk of the escape of even small amounts of oil with a high degree of reliability and with low maintenance expense.

This objective is achieved by a device of the general type described above for recirculating oil, which is characterized by a conical ring body with a conical outer surface and a cylindrical inner surface that is seated on the outer surface of the sealing race and is sealed from said race, such that the inclination of the conical outer surface towards the end face of the barrel runs towards the roll axis, and by an additional, second conical ring body that is rigidly mounted in the bearing housing and has a conical inner surface, which is arranged some distance opposite the conical surface of the first conical ring body, such that the two conical surfaces form a hydraulic pump

gap that conveys oil away from the end face of the roll barrel.

In this regard, as the invention provides, the end of the pump gap that faces the roll barrel can open in an annular admission chamber, which is formed by lateral surfaces of the first conical ring body, which run in the radial direction relative to the axis and inclined thereto, by the radial lateral surface of a flange-like annular shoulder of the second conical ring body, which (radial lateral surface) lies some distance opposite the lateral surfaces of the first conical ring body, and by an outer surface section of the sealing race. In this regard, the outlet end of the pump gap that faces away from the roll barrel can open into an annular oil collection chamber, which is formed by a radially running lateral surface of the second conical ring body, by a lateral surface of a flange-like annular shoulder that is rigidly mounted in the bearing housing and lies some distance opposite the aforesaid lateral surface of the second conical ring body, and by a sidewall section of the first conical ring body, such that radial conveying channels, which are located in the bearing housing, and an outlet channel, which is located downstream of the radial conveying channels, are assigned to the oil collection chamber.

The first conical ring body can have a contact surface that

is axially spaced from the outlet end of the pump gap PS and runs in the radial direction relative to the axis for seating on an annular seat, which likewise runs in the radial direction relative to the axis, in the stationary part of the bearing and can be made of a wear-resistant material.

This device is distinguished not only by greater reliability with a cost of construction that involves only a few parts; it can also be installed in existing sealing systems without much additional expense, since it occupies no more space than that occupied by double sealing systems, which are no longer needed. The device is also suitable for use in rolling mill bearings designed for other applications.

The invention is explained below with reference to the specific embodiment illustrated in the drawings.

-- Figure 1 shows the roll bearing in an axial section.

-- Figure 2 shows an enlarged detail drawing from the drawing in Figure 2.

-- Figure 3 shows the detail drawing in Figure 2 further enlarged.

As Figure 1 shows, the roll bearing consists of a pair of radial roller bearings seated on the neck WZ of the roll W and of a deep-groove-type radial ball bearing RDL seated on the end

WZE of the neck that faces away from the roll barrel WB. The radial roller bearings are inserted in the bearing chock LES, and the deep-groove-type radial ball bearing RDL is seated in a terminal ring body ARK, which is mounted on the bearing chock LES on the side of the bearing chock LES that faces away from the roll barrel WB. On the other side of the bearing chock LES that faces the roll barrel WB, an intermediate ring body ZRK is mounted, which is furnished with sealing elements and sealing devices that will be explained in greater detail later.

Oil is supplied (by means that are not shown) to the bearings through admission channels ZFK and conveying channels FK connected with the admission channels ZFK and is removed again through outlet channels AK.

Figures 2 and 3 show that a sealing race DLR is mounted on the neck WZ between the roll barrel WB and the radial roller bearings RRL. The outer peripheral surface of the sealing race DLR is sealed by an elastic labyrinth ring LR, which is rigidly connected with the intermediate ring body ZRK. In addition, a first conical ring body KRK1 with a cylindrical inner surface is mounted on the cylindrical outer surface of this sealing race DLR, and the outer ring surface ARF of the first conical ring body KRK1 runs in the direction away from the roll barrel WB and

is inclined towards the roll axis x-x (Figure 1). A second conical ring body KRK2 is seated in the intermediate ring body. Its inner ring surface IRF, which also runs at an inclination and is spaced some distance from the outer ring surface ARF of the first conical ring body KRK1, forms, together with the outer ring surface ARF of the first conical ring body KRK1, a conical annular gap, i.e., the pump gap PS. The outlet end of the pump gap PS faces away from the roll barrel WB and opens into an oil collection chamber OSK, which is connected with an outlet channel AK by conveying channels FK, and the admission end of the pump gap PS faces towards the roll barrel WB and opens in an annular admission chamber EK. The admission chamber EK is formed by lateral surfaces of the first conical ring body KRK1, which run in the radial direction relative to the axis and inclined thereto, by the radial lateral surface of a flange-like annular shoulder RA of the second conical ring body, which (radial lateral surface) lies some distance opposite the lateral surfaces of the first conical ring body KRK1, and by an outer surface section of the sealing race DLR.

The first conical ring body KRK1 is made of a wear-resistant material and has an annular contact surface ANF, which is axially spaced from the outlet end of the pump gap PS and

runs in the radial direction relative to the axis, for seating on a likewise annular seat AUF, which also runs in the radial direction relative to the axis and is mounted on a rigidly mounted ring segment RS of the bearing.

Since the first conical ring body KRK1 rotates about the stationary second conical ring body KRK2 during the rolling operation, the gap PS formed between them acts as a hydraulic centrifugal pump, which sucks out portions of oil that have entered the admission chamber EK from the bearing in the area of the end face ST of the roll barrel and the outer surface of the sealing race and returns them to the oil circulation via the oil collection chamber OSK, the conveying channels FK, and the outlet channel AK, thereby preventing the oil from getting onto the end face ST of the roll barrel WB and from there onto the peripheral surface of the roll barrel.

The device is also suitable for sucking out small amounts of fluids that get into the bearing via the roll barrel from the outside through defective seals, such as cooling water or residual lubricant emulsion, and removing them via the oil circulation of the bearing.

List of Reference Code Letters

RRL	radial roller bearings
RDL	deep-groove-type radial ball bearing
LES	bearing chock
W	roll
WB	roll barrel
WZ	roll neck
ST	end face (of the roll barrel WB)
WZE	(stepped) end of the neck WZ
ARK	terminal ring body
ZRK	intermediate ring body
ZFK	admission channel
FK	conveying channel
AK	outlet channel
DLR	sealing race
LR	labyrinth ring
KRK1	conical ring body (first)
KRK2	conical ring body (second)
x-x	roll axis
IRF	inner ring surface
ARF	outer ring surface

PS pump gap

OSK oil collection chamber

EK admission chamber

ST end face (of the roll barrel WB)

RA (flange-like) annular shoulder

ANF contact surface

AUF seat

RS ring segment

CLAIMS

1. Method for hot dip coating a metal strand (1), especially steel strip, in which the metal strand (1) is passed vertically through a coating tank (3) that holds the molten coating metal (2) and through an upstream guide channel (4) of well-defined height (H), wherein an electromagnetic field is generated in the region of the guide channel (4) by means of at least two inductors (5) installed on either side of the metal strand (1) for the purpose of retaining the coating metal (2) in the coating tank (3), and wherein a predetermined volume flow (Q) of coating metal is supplied to the guide channel (4) in the region of its vertical extent (H), characterized by the fact that the predetermined volume flow (Q) of coating metal (2) supplied to the guide channel (4) represents a portion of the replenishment volume of coating metal (2) or the entire replenishment volume of coating metal (2) per unit time that is necessary to maintain a desired level (h) of coating metal (2) in the coating tank (3).

2. Method in accordance with Claim 1, characterized by the fact that the volume flow (Q) of coating metal (2) that is supplied to the guide channel (4) is supplied under open-loop or closed-loop control.

3. Device for hot dip coating a metal strand (1), especially steel strip, in which the metal strand (1) is passed vertically through a coating tank (3) that holds the molten coating metal (2) and through an upstream guide channel (4), with at least two inductors (5) installed on either side of the metal strand (1) in the area of the guide channel (4) for generating an electromagnetic field for retaining the coating metal (2) in the coating tank (3), wherein at least one supply line (6, 7, 8, 9) for supplying a predetermined volume flow (Q) of coating metal (2) opens into the guide channel (4) in the region of the vertical extent (H) of the guide channel (4), for carrying out the method in accordance with Claim 1 or 2, characterized by the fact that the supply line (6, 7, 8, 9) opens into the region of the long side (11) and into the region of the short side (10) of the guide channel (4).

4. Device in accordance with Claim 3, characterized by the fact that the width (B) or the diameter of the supply line (6, 7, 8, 9) is small relative to the dimension of the long side (11) of the guide channel (4).

5. Device in accordance with Claim 4, characterized by the fact that the width (B) or the diameter of the supply line (6, 7, 8, 9) is no more than 10% of the width of the long side (11) of the guide channel (4).

6. Device in accordance with any of Claims 3 to 5, characterized by the fact that the coating tank (3) is connected to a supply system (12) for coating metal (2), from which coating metal (2) is conveyed into the supply line or supply lines (6, 7, 8, 9).